

**TECHNICAL
DATA SHEET**

No. 501

SOLDERS

INDUSTRIAL DIVISION

Leach & Garner

COMPANY

ATTLEBORO • MASSACHUSETTS

INDUSTRIAL DIVISION

General Findings INC.

ATTLEBORO • MASSACHUSETTS

INTRODUCTION

Silver solders and brazing alloys were once used almost exclusively in the arts. At that time the variety was small and the metallurgical requirements narrow, but with the development of furnace brazing and the realization that solders could be developed to suit a wide variety of commercial requirements, new compositions made their appearance and found ready acceptance where strong bonds and ease of manipulation were required. Preforms, solder flushed backings, preplacement of solder for furnace and induction brazing became common. To meet these many and diversified requirements, Leach & Garner Company developed a wide range of silver alloys having special characteristics.

Leach & Garner silver solder alloys comprise well over 100 different compositions. Many of these are proprietary and not in general demand, and have, therefore, been omitted from the list herein presented.

CLASSIFICATION OF SILVER SOLDERS

Silver solders, often termed "silver brazing alloys", consist of two primary groups. The first is a group of eutectic alloys with narrow melt and flow ranges; and the second, alloys containing eutectic components with additions that perform such special purposes as "wetting" agents, higher melting phases, specific colors, or strength and/or ductility.

SELECTION OF PROPER SOLDERS

The proper selection of a solder will depend on many factors. Where slow heating, such as furnace brazing, is employed, solders of the eutectic type are usually preferred as they have a short "melt and flow" range which reduces "skulls" and porosity in the solder joint. Occasionally some sacrifice of the favorable aspects of eutectic solders must be made to aid in closing loose fits or to improve "wetting" action.

Torch brazing, resistance and induction brazing all provide rapid heating whereby the solder melts on such a rapid rise that the higher melting constituents melt and flow freely. Consequently, these techniques allow the use of solders with wider melt and flow ranges. In these cases, especially where preformed solder is used and clearances are relatively large, clean joints can be produced with good fillets.

A SELECTED LIST OF LEA

Item	L&G #	Sil.	Cu.	Zn.	Cd.	Others	Melt & Flow
							Solidus
1	53	80	16	4			1350
2	42	75	20	5			1340
3	33	72	28	Eutectic			1435
4	54	70	20	10			1270
5	1	66.7	22.3	11			1280
6	2	66.7	27.7	5.4			1350
7	55	65	20	15			1250
8	62	66	25.8	8.2			
9	37	60	15	20		Ni 5	1230
10	22	60	20	10	10		1285
11	40	60	25	15			1250
12	52	54.5	15.5	14	15	Sn 1	1130
13	50	50	15	16	19		1145
14	76	50	15	16	16	Ni 3	1170
15	49	45	30	25			1220
16	82	45	15	16	24		1120
17	63	40	30	28		Ni 2	1220
18	64	40	30	25		Ni 5	1225
19	68	40	18	15	27		1130
20	99	40	35	25			1340
21	96	35	26	21	18		1125
22	36	20	45	30	5		1360
23	58	20	45	35			1350
24	24	18	47	35			1440
25	56	10	52	38			1470
26	39	7	56	37			1575

CH & GARNER SOLDERS

Temp	Recmd. Soldering Temps °F	PSI X 1,000 Tensile Stg. as Cast	ASTM B 73- 29	B260-52T	Federal QQ-5-56id	Ships Amend 15 April 1951 Navy 47-S-13e Mi 1 S-15395	Item
Liquidus							
1460	1500	40	8				1
1420	1450	40					2
1435	1450	40					3
1375	1400	40	7	B260-52T			4
1320	1350						5
1390	1400						6
1300	1350	30	6	B260-52T	2	II	7
							8
1545	1575						9
1335	1350						10
1320	1350	45					11
1190	1200						12
1160	1175	60			4	IV	13
1240	1270	60		B260-52T	5	V	14
1350	1375	55	4	B260-52T			15
1145	1150	60		B260-52T	7	VII	16
1415	1400	50		B260-52T			17
1470	1500	50					18
1195	1200	55					19
1405	1400	55					20
1295	1300	50					21
1490	1500	32	3				22
1480	1480	55	2		0	0	23
1500	1500						24
1575	1580	65					25
1600	1600	33	1				26

The use of solders containing nickel is advantageous on metals that are hard to wet such as tungsten and steel.

Silver, Copper, Zinc alloys are preferred for general purpose where ductility is required. Alloys containing 60% or more of Silver are the most ductile.

Low zinc and cadmium solders must be used for vacuum soldering due to low vapor pressures of both elements when in liquid state.

PREPARATION OF SOLDER AREA

All surfaces to be silver soldered must be clean and dry. Oil, grease and scale must be removed from all faces. Solder preforms and rings should be cleaned by acid pickling or sand-tubbing to remove the surface film and aid in the breakdown and flow of the solder. Care must be taken to avoid contamination of prepared surfaces from finger marks and oil. It is well to flux the joint as soon as possible after preparation. A solution of borax or borax and boric acid is usually sufficient as a flux. Proprietary fluxes usually containing halogen salts may be used where refractory scale forms on heating and must be removed. Atmosphere furnace brazing usually requires no flux if the atmosphere is reasonably dry.

COLORS

Silver solders range from yellow brass-like colors in the low silver-high copper solders to silver white in alloys over 60% silver.

AVAILABLE FORMS

Leach & Garner silver brazing alloys are available as sheet, wire, cut and burred to 36, 50, 76, and 100 mesh. For saw brazing and similar use we carry in stock sizes from 1/2" wide in 1/8" increments to 1" wide in .003" and .004" thicknesses. These are packed in brass boxes containing 1 troy ounce each.

Preforms are available from our affiliate, the General Findings, Inc. All shapes and sizes available on custom basis.

PRICING:

Market fluctuations of fine Silver naturally affect prices of silver brazing alloys. Quotation requests should specify type alloy, size, shape and quantity, and should be directed to:

or to:

**INDUSTRIAL DIVISION
Leach & Garner Company
Attleboro, Massachusetts**

TECHNICAL
DATA SHEET

No. 301

CONTACT
MATERIALS

INDUSTRIAL DIVISION

Leach & Garner

COMPANY

ATTLEBORO • MASSACHUSETTS

INDUSTRIAL DIVISION

General Findings INC.

ATTLEBORO • MASSACHUSETTS

GENERAL

Contact materials fall into several basic groups. Each group may have many of the same characteristics but differ in one or two important aspects. Controlling the choice of alloy may be one or more of the following factors:

- | | |
|-----------------------------------|---|
| 1. Electrical load — | voltage and current; type-inductive or capacitive |
| 2. Atmospheric conditions — | |
| 3. Allowable contact resistance — | |
| 4. Mechanical features — | spring properties desired; manner of contact; configuration of contacts |
| 5. Performance characteristics — | wear resistance required for desired life; tendency to metal transfer; permissible contact noise; arc suppression |
| 6. Price — | |

ALLOYS

Fine Silver

This is the most widely used of all contact materials. It offers the lowest resistance and highest current carrying capacity of all metals. Its disadvantage lies in its softness and subjection to sulphide formation which precludes its use in certain atmospheres unless a strong wiping action serves to keep the surface clean. High contact pressures and impact closures will upset the surface and distort the contact area. Fine silver is available in all commercial forms of wire, sheet, and tubing as well as rings, washers, rods, discs and special shapes.

Coin Silver

An alloy of 90% silver and 10% copper yields a considerable increase in hardness and reduces wear and deformation in contrast to fine silver where high contact pressures are used. Lower material transfer than fine silver in low voltage D. C. circuits and consequently less sticking or welding at the higher current values. Being a duplex alloy with high copper phases present, it is lower in tarnish resistance than fine silver and therefore has slightly higher surface resistance on pressures under 50 grams. Above 50 grams pressure it is usually preferred to fine silver because of its higher hardness and lower price. Coin silver is available in all form produced in fine silver.

In the Silver group are found several Leach & Garner alloys which have been developed to meet various specific demands. These are Silver-Copper, Silver-Copper-Nickel, Silver-Cadmium, Silver-Platinum and Silver-Palladium.

Leach & Garner Alloy No. 206

A Silver-Copper-Nickel alloy considerably harder than coin silver which has many of the advantages of coin silver with the added features of increased temper and wear resistance, stiffness for blade type applications and lower cost. Less corrosion resistance than Fine or Coin Silver, therefore wiping action is recommended.

Leach & Garner Alloy No. 207

Is similar to No. 206 Alloy with increased nickel content making it even harder. As in Alloy No. 206, a wiping action is recommended.

Leach & Garner Alloy No. 209

An alloy substitute for coin silver which is somewhat harder and less expensive. Less corrosion resistance and generally inferior in electrical properties to coin silver. However, added hardness yields somewhat better mechanical properties.

Leach & Garner Alloy No. 216

A Silver-Copper-Zinc Alloy — ASTM Grade VIII Silver Solder. This alloy has found acceptance for many applications requiring wear resistance, strength and resiliency, with good electrical properties. As in all cases of lower silver content, surface corrosion could eliminate its use unless adequate wiping action were applied. Although less conductive than Fine and Coin Silver generally chosen for hardness, spring properties, and economy.

Leach & Garner Alloy No. 214

A Silver-Copper eutectic containing 72% Silver and 28% Copper whose use is similar to Alloy No. 216. It is a hard springy alloy suitable for contacts and contact fingers especially where stiffness is required along with relatively good conductivity.

Leach & Garner Alloy No. 218

Silver-Cadmium alloy. The presence of cadmium gives good arc suppression which reduces heating and metal transfer. This alloy may be had with various ratios of Silver and Cadmium depending on load requirements. It is relatively soft so should not be used on impact closures unless deformation is not important. It is especially adaptable to large contacts as found in circuit breakers where heavy loads must be interrupted with minimum arcing. It operates best in air atmosphere where the cadmium has an opportunity to oxidize.

Leach & Garner Alloy No. 203

A Silver alloy containing 3% Palladium. Electrically and mechanically it compares closely to fine silver but has higher resistance to sulphide atmosphere. Used where good contact surface and light pressure is desired. Somewhat more economical than Alloy No. 204, it has slightly better thermal and electrical conductivity but corrosion resistance is slightly less.

Leach & Garner Alloy No. 204

A Silver Alloy containing 3% Platinum. Electrically and mechanically, it compares closely to fine silver. Has higher resistance to oxidation, corrosion, and film formation and better wear resistance than Fine Silver or Alloy No. 203. Particularly used in sensitive devices requiring light contact pressure, long life, and resistance to metal transfer. Improved characteristics most marked in low or moderate current inductive circuits.

A second group of alloys containing Gold, Silver, Platinum and Palladium were developed primarily for corrosion resistance, excellent wear characteristics and high conductivity. In addition some of these alloys afford high spring properties, low contact pressure, and low noise level. Nickel and Copper are added in certain alloys. Use is predominant in highly corrosive atmosphere and where severe wear is involved. Generally expensive, the excellent performance of these alloys definitely warrants their use.

Leach & Garner Alloy No. 201

An alloy of 69% Gold, 25% Silver and 6% Platinum is in wide usage. Low noise level, uniformity of resistance, light pressures required, low metal transfer, and lack of surface "skin", make this alloy suitable for microbrushes, potentiometer components and collector ring applications.

Leach & Garner Alloy No. 205

An alloy of Gold, Platinum, Silver and Copper with precious metal content of approximately 85%, this material has the additional feature of heat treatability for maximum hardness. High tarnish resistance plus excellent wear characteristics (tensile strengths up to 160,000 p. s. i. are attainable) make it a favorite choice for contact springs and wiper brushes. Contact pressures are retained indefinitely. Recommended for use in contact with alloy No. 201 and Coin Silver.

Leach & Garner Alloy No's 211, 212 and 213

All are 18 Karat Golds with additions of Nickel to produce progressively harder alloys for contact rivets and slide wire applications. Pressures may be light and contacts will remain tarnish-free in practically all atmospheres. Recommended for low electrical burdens, and low closing forces with negligible metal transfer. Of high value where reliability is of extreme importance and as a substitute for Platinum-Iridium alloys in instances where low surface resistance and low metal transfer must be maintained.

Leach & Garner Alloy No. 215

Another 18 Karat Gold alloy which is extremely hard and springy. Used primarily for brushes and springs under light loads, where wear resistance is important. Chosen occasionally as a substitute for Leach & Garner Alloy No. 226H.

Leach & Garner Alloy No. 226H

An alloy with approximate composition of 30% Silver, 35% Palladium, 10% Platinum, 10% Gold and Copper. An accepted alloy in the electronic field, this alloy can be heat treated to values as high as 350 VHN from the annealed state. This property, along with its excellent tarnish resistance, makes it ideal for all low current level applications and slide wire use, especially against nichrome wire coils. It is a high resistance alloy in the order of 210 ohms/cm² annealed and 190 ohms/cm² heat treated. This alloy may be had in strip or wire and, in some instances, tubing. Where severe wear is encountered and low mechanical friction desired, Leach & Garner Alloy No. 226H is an ideal choice.

In addition to the above special alloys, Leach & Garner Company produces all standard precious metal alloys in solid and laminated mill forms. Specific laminations (Clad to Non-ferrous base metals) are available as: Overlay, Thrulay, Inlay, Edgelay and Toplay.

Laminated contact metals provide the electrical properties of precious metal alloys with the mechanical and economical advantage of non-ferrous metals.

Prompt recommendations and quotations available upon request.

Address inquiries to:

INDUSTRIAL DIVISION
Leach & Garner Company
Attleboro, Massachusetts